NSCMP

Non-Stockpile Chemical Materiel Project

Mission Statement

To provide Centralized Management and Direction to the Department of Defense for the Disposal of Non-Stockpile Chemical Materiel in a Safe, Environmentally Sound, and Cost-Effective Manner.

Overview

The United States produced chemical warfare agents from 1917 until 1968 for use in World War I and later to deter other countries from using chemical weapons against U.S. or allied forces. There are many types of chemical agents, which were typically stored in large bulk containers or loaded into munitions. Such materiel makes up the nation's chemical weapons "stockpile," and is stored at eight Army installations in the U.S. and on Johnston Island in the Pacific Ocean. The U.S. Army was directed to destroy the chemical weapons stockpile under the Department of Defense Authorization Act of 1986. In addition, the U.S. has signed and ratified the Chemical Weapons Convention (CWC), an international treaty that requires the destruction of chemical weapons and chemical weapons production facilities.

There are also five categories of chemical warfare materiel (CWM) that are not part of the chemical weapons stockpile. These types of CWM are known as "non-stockpile chemical materiel." The five categories are: binary chemical weapons; former production facilities; miscellaneous chemical warfare materiel; recovered chemical warfare materiel; and buried chemical warfare materiel.

The Non-Stockpile Chemical Materiel Project (NSCMP), which is under the U.S. Army Program Manager for Chemical Demilitarization (PMCD), was established to provide centralized management and direction to the Department of Defense for the disposal of non-stockpile chemical materiel in a safe, environmentally sound, and cost-effective manner.

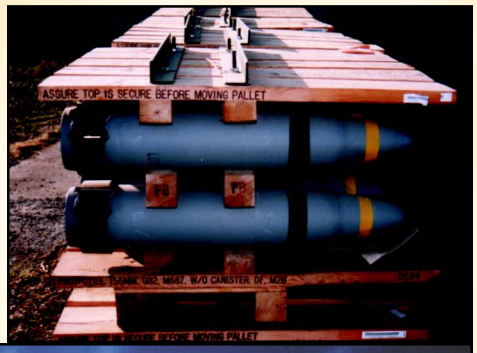
The Product Manager for Non-Stockpile Chemical Materiel (PM NSCM) is charged with ensuring that the program identifies actual and potential locations of non-stockpile chemical materiel (NSCM); researches, develops, acquires, and operates systems that are capable of characterizing, storing, treating, and disposing of non-stockpile chemical materiel; develops schedules and cost estimates for storage, treatment, and destruction plans; and supports U.S. treaty obligations.

CWM is being safely recovered and stored across the country using state-of-the-art technologies. Portable Isotopic Neutron Spectroscopy Systems, Raman Spectrophotometers, and Mobile Munitions Assessment Systems are used to assess the condition and contents of recovered CWM. Interim Holding Facilities provide safe and secure storage until responsible managers can arrange transportation or treatment. Transportable treatment systems, such as the Rapid Response System and a family of Munitions Management Device systems, are being developed to safely treat munitions and other recovered materiel at or near the recovery site.

Recovered non-stockpile chemical materiel is not part of the U.S. stockpile stored at eight continental United States sites.

The quantities of non-stockpile chemical materiel recovered have been and will continue to be very small compared to the chemical weapons stockpile. To illustrate this, strictly from a physical space perspective, all of the non-stockpile chemical materiel collected over the past 20 years awaiting disposal could fit inside one 25 by 80 foot storage building (although storage safety rules preclude this from happening). The NSCMP is continually reviewing and developing treatment options to ensure that the destruction of non-stockpile chemical materiel is in accordance with CWC treaty obligations; local, state, tribal and federal laws; and health, safety, and environmental requirements.

5 Categories of Chemical Warf



Pictured top to bottom:

1. *Binary munitions await shipment for recycling.*
2. *Former production facility at the Newport Chemical Depot, Indiana.*
3. *Ton containers formerly used to store chemical agent.*
4. *Workers package recovered chemical warfare materiel for transport.*
5. *An example of buried chemical warfare materiel.*

The Non-Stockpile Chemical Materiel Project is responsible for five categories of chemical warfare materiel that are not part of the U.S. chemical weapons stockpile. These five categories are: binary chemical weapons; former production facilities; miscellaneous chemical warfare materiel; recovered chemical warfare materiel; and buried chemical warfare materiel.

fare Materiel

Binary Chemical Weapons

Binary chemical weapons were designed to form lethal chemical agents by mixing two less toxic chemicals inside a munition during its flight to a target. Each non-lethal chemical was manufactured, stored, and transported separately. The U.S. never used binary weapons in battle.

Former Production Facilities

Former production facilities were used to produce chemical agents and their precursors, assemble components of chemical weapons, and load and fill munitions. The Chemical Weapons Convention (CWC), which the U.S. ratified in 1997, bans the use of production facilities and requires their destruction or conversion to peaceful uses.

Miscellaneous Chemical Warfare Materiel

Miscellaneous chemical warfare materiel is divided into three groups:
(1) CWC Category 3 items, which are unfilled munitions and devices, and equipment specifically designed for use in connection with the employment of chemical weapons; (2) ton containers formerly used to store chemical agent; and (3) chemical samples.

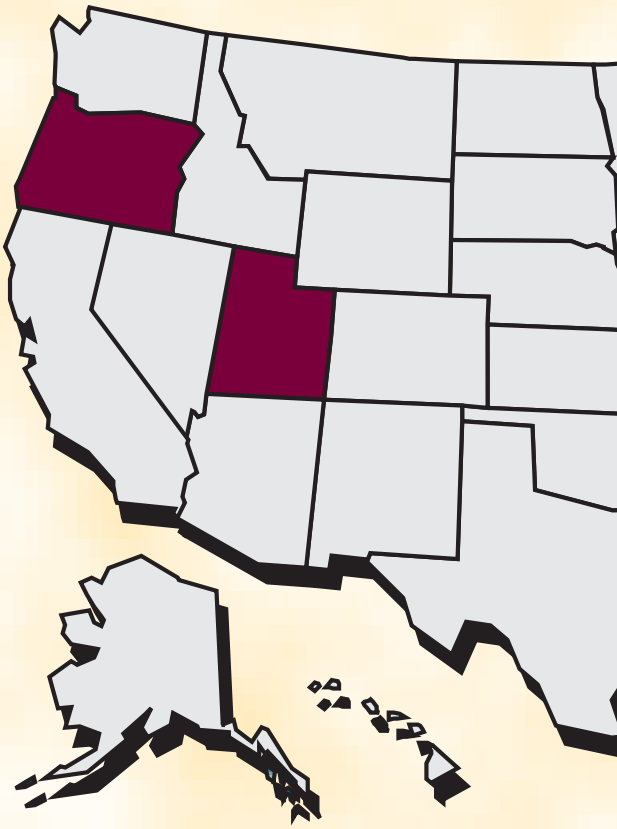
Recovered Chemical Warfare Materiel

Recovered chemical warfare materiel (CWM) includes items recovered from firing ranges, chemical weapons burial sites, and other locations. The NSCMP develops and operates specialized treatment systems to destroy recovered CWM carefully, in accordance with environmental regulations.

Buried Chemical Warfare Materiel

Buried chemical warfare materiel are items that are currently buried on land or are underwater near land disposal sites. Burial of chemical warfare materiel was an accepted disposal practice until the late 1950s. Items were usually treated before burial (e.g., burned or chemically neutralized), but some burial sites may still contain materiel with untreated chemical agent. When suspected CWM is found, specially trained personnel are called to the site to assess the content and condition of each item and determine if it is safe for storage or transportation. Once an item is determined to contain chemical agent, it becomes a "recovered" item.

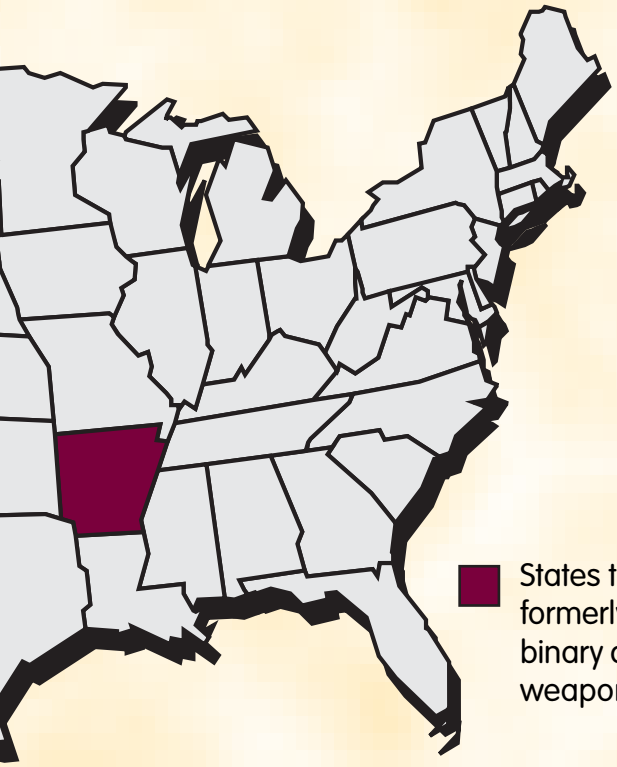
- **Deseret Chemical Depot, Utah**
- **Pine Bluff Arsenal, Arkansas**
- **Umatilla Chemical Depot, Oregon**



Binary Chemical Weapons

Binary chemical weapons await shipment at Umatilla Chemical Depot, Oregon.

The U.S. Army developed binary chemical munitions in the early 1980s to replace its aging unitary chemical weapons stockpile. Unitary chemical munitions contain a single lethal chemical agent, while binary chemical weapons, when fully loaded under battle conditions, contain two separate canisters filled with less toxic, non-agent liquid compounds. These compounds were designed to mix when fired and form a lethal chemical agent en route to the designated target. For safety and security reasons, binary chemical weapons were manufactured, stored, and transported with only one chemical component inside the munition.



States that store or formerly stored binary chemical weapons

The Department of Defense tested two binary weapons systems: the Bigeye Bomb and the M687 155mm projectile. Another binary weapons system, the Multiple Launch Rocket System, was designed but never tested. Only the M687 projectile reached full-scale production. All Bigeye Bombs and M687 projectiles were destroyed from 1997-1999 to meet the requirements of the Chemical Weapons Convention.

The M687 projectiles were composed of a steel body, an aluminum nose piece with an explosive filler, and a canister containing a non-lethal liquid compound of isopropyl alcohol and isopropylamine, known as OPA. A second canister filled with the liquid precursor di-fluoro (DF) was produced and stored separately. The DF canister was loaded only with command approval under battle conditions. Separation discs between the canisters would rupture upon firing and the spin of the projectile in-flight would mix the two less toxic chemicals, forming the nerve agent GB. The M687 projectiles and the OPA canisters are stored at Umatilla Chemical Depot in Oregon and at Deseret Chemical Depot in Utah. The DF canisters are stored at Pine Bluff Arsenal in Arkansas.

The Non-Stockpile Chemical Materiel Project began an operation in 1997 to recycle its M687 binary projectiles. The first phase of this effort involved 201,728 projectiles stored at Umatilla Chemical Depot. These projectiles were transported to Hawthorne Army Depot, in Nevada, where the recycling and recovery operations took place. The project was completed in March 1999.

Unitary chemical munitions contain a single lethal chemical agent, while binary chemical weapons, when fully loaded under battle conditions, contain two separate canisters filled with less toxic, non-agent liquid compounds.

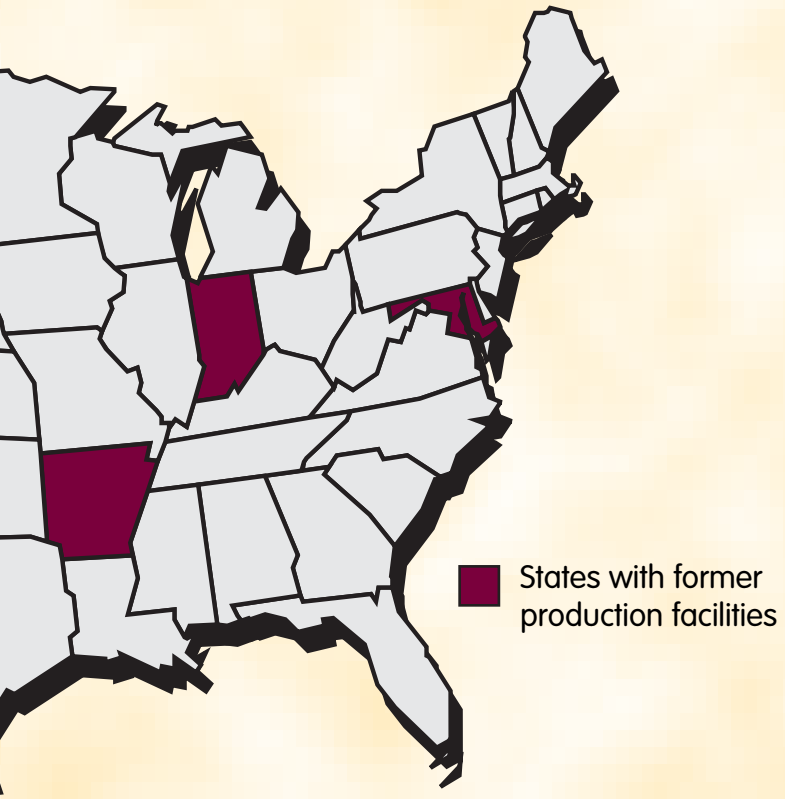
The first step in the M687 binary projectile recycling process was to remove the OPA liquid-filled canister. The OPA liquid was drained, collected, and shipped off site for disposal. The canister was then shredded and disposed of in a regulated, non-hazardous solid waste landfill. Next, an abrasive water jet cut the aluminum nose piece from the steel projectile body and the aluminum nose piece explosive was removed. Once the explosive nose piece had been separated, the steel munition body was sold as scrap metal. Finally, a melt-out process removed the explosive from its aluminum nose piece. The explosive was dried and packaged for reuse, and the aluminum casing was melted into bars and sold for commercial use.

- **Aberdeen Proving Ground, Maryland**
- **Newport Chemical Activity, Indiana**
- **Pine Bluff Arsenal, Arkansas**
  - Former BZ Munitions Fill Facility
  - Integrated Binary Production Facility

Former Production Facilities

The former Pilot Plant Complex at Aberdeen Proving Ground, Maryland.

The Chemical Weapons Convention (CWC) stipulates that all chemical weapons production facilities that were designed, constructed, or used after January 1, 1946, must be declared and destroyed. The Non-Stockpile Chemical Materiel Project is responsible for the destruction of former chemical weapons production facilities at Pine Bluff Arsenal, Arkansas; Newport Chemical Depot, Indiana; and the Edgewood Area of Aberdeen Proving Ground, Maryland. Other former production facilities are either closed, converted or are being demolished by other Army organizations.



Pine Bluff Arsenal

Pine Bluff Arsenal in Arkansas is home to two former chemical weapons production facilities that were declared under the terms of the CWC: the BZ Munitions Fill Facility and the Integrated Binary Production Facility. Munitions or components were filled at Pine Bluff Arsenal with mustard, lewisite, DF, and BZ. Mustard, lewisite, and DF also were manufactured at Pine Bluff Arsenal. Destruction of the BZ facility was completed in 1999, and the remaining facility is scheduled to be completed by 2007.

Newport Chemical Depot

The former chemical weapons production facility at the Newport Chemical Depot produced all of the chemical nerve agent VX in the U.S. stockpile. Production of VX began in 1961 and ended in 1968. Approximately 4,400 tons of VX were produced at the plant while it was in operation. Most of the agent was loaded into munitions that became part of the U.S. chemical weapons stockpile. Destruction of the facility will occur in three phases, and is scheduled to be completed by 2007. The first phase started in 1998.

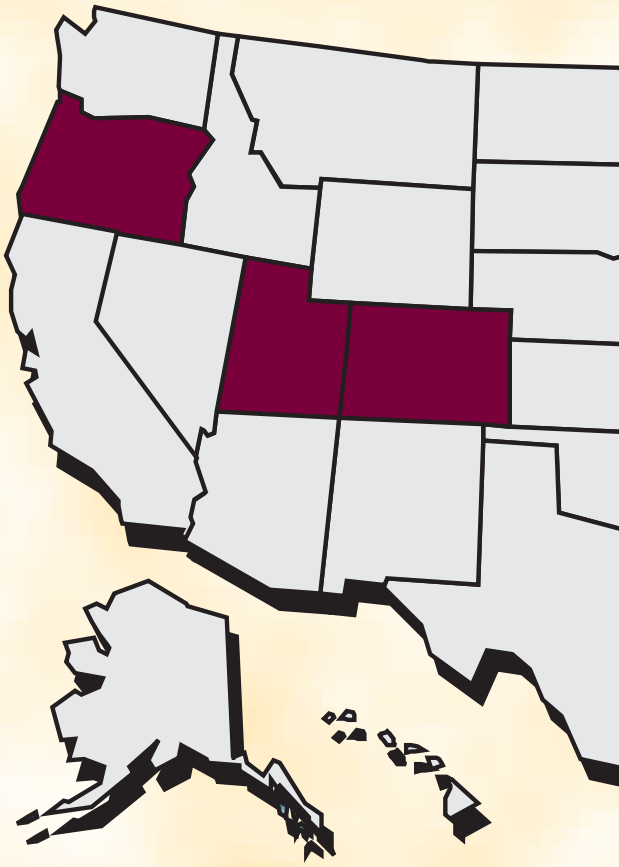
Pilot Plant Complex

The former chemical agent production facility known as the Pilot Plant Complex, located at the Edgewood Area of Aberdeen Proving Ground, Maryland, was built in 1942. The complex was originally built to produce chemically coated uniforms that protected soldiers against mustard agent. Production of chemical warfare materiel and chemical agents, such as G-series nerve agents and incapacitating agents, began at the Pilot Plant Complex in the mid-1940s. The facility was used for research and development activities on chemical agents and binary chemical weapons until it closed in 1986.

The complex consists of a main structure and eight support buildings. Six of the support buildings were demolished in 1998. The remaining support buildings and the main building will also be demolished. The project is scheduled to be completed in early 2000.

These facilities produced chemical agent, made intermediate chemical precursors in the production process, or were used for loading or filling munitions.

- Aberdeen Proving Ground, Maryland
- Anniston Army Depot, Alabama
- Blue Grass Army Depot, Kentucky
- Deseret Chemical Depot, Utah
- Dugway Proving Ground, Utah
- Pine Bluff Arsenal, Arkansas
- Pueblo Chemical Depot, Colorado
- Umatilla Chemical Depot, Oregon



Miscellaneous Chemical Warfa

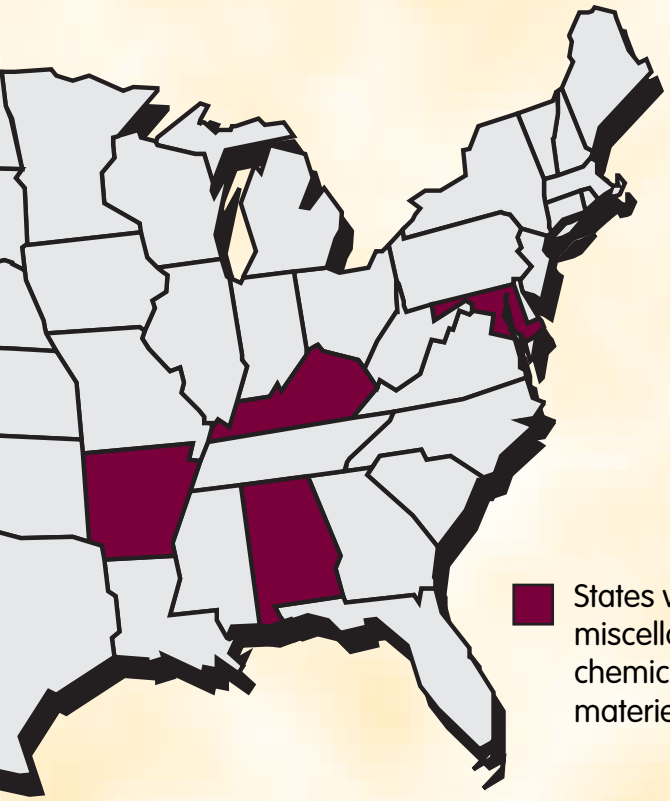
Miscellaneous Chemical Warfare Materiel is divided into three groups: Category 3 items; ton containers formerly used to store chemical agent; and chemical samples.

Category 3 Items

As defined by the Chemical Weapons Convention (CWC), Category 3 items include unfilled munitions and devices, and equipment specifically designed for use directly in connection with the employment of chemical weapons. These items do not contain chemical agent.

Under the terms of the CWC, Category 3 items are required to be destroyed by 2002. They will be crushed using heavy equipment or cut into pieces using a torch. Inspectors from the Organization for the Prohibition of Chemical Weapons will verify destruction of the items, the scrap metal will be recycled, and any remaining material will be landfilled. Most Category 3 items under control of the Non-Stockpile Chemical Materiel Project have already been destroyed. The associated explosive components, munition bursters, and fuzes were destroyed by detonation in environmentally permitted disposal programs.

Miscellaneous Chemical Warfare Materiel is divided into three groups: Category 3 items; ton containers formerly used to store chemical agent; and chemical samples.



States with miscellaneous chemical warfare materiel

are Materiel

Ton Containers

Ton containers are thick-walled steel barrels with a 170-gallon capacity, and are used for a variety of commercial uses. Empty ton containers that were once used to store and ship bulk chemical agent are currently being recycled by the Non-Stockpile Chemical Materiel Project. The recycling process begins with each ton container being chemically decontaminated. The ton containers are then cut in half, debris is removed, and the parts are heated in a metal parts furnace. Following this thermal decontamination the ton container pieces are sold as scrap metal.

Over 1,700 ton containers have already been recycled at Aberdeen Proving Ground in Maryland. This effort yielded approximately 1,300 tons of high-grade steel, which was smelted and sold for commercial use. Future operations will include recycling more than 5,000 additional ton containers that are currently stored at Pine Bluff Arsenal in Arkansas and Deseret Chemical Depot in Utah. These recycling initiatives are expected to produce over 3,700 tons of high-grade steel.

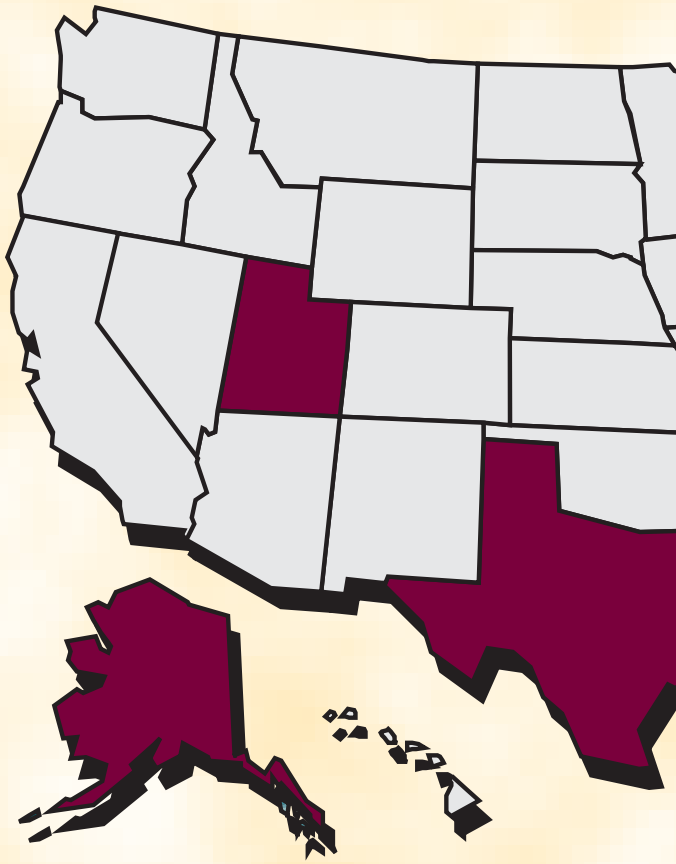
Chemical Samples

The Army has occasionally transferred agent from research projects or from leaking, recovered, and stockpiled munitions into glass vials, metal cylinders, Department of Transportation standard steel bottles, and ton containers. This was done to ensure safe storage of agent, assess the quality of agent in the stockpile, or ascertain the causes and seriousness of leaking munitions. These chemical samples, which are currently stored at eight sites throughout the continental United States, are Schedule 1 chemicals as defined by the CWC and must be destroyed by 2007.

Chemical Sample Storage Locations
(Part of the Miscellaneous Chemical Warfare Materiel Category)

Location	Amount and Type of Samples
Aberdeen Proving Ground	14 Cylinders 182 Overpacks 4 Ton Containers
Anniston Army Depot	12 DOT Bottles 36 Glass Vials 2 Ton Containers
Blue Grass Army Depot	3 DOT Bottles 1 Ton Container
Deseret Chemical Depot	49 Glass Ampoules 1 Ton Container
Dugway Proving Ground	90 DOT Bottles
Pine Bluff Arsenal	2 Ton Containers 1 Glass Vial
Pueblo Chemical Depot	12 DOT Bottles
Umatilla Chemical Depot	5 Ton Containers

- Aberdeen Proving Ground, Maryland
- Camp Bullis, Texas
- Deseret Chemical Depot, Utah
- Dugway Proving Ground, Utah
- Fort Richardson, Alaska
- Johnston Island, Pacific Ocean
- Pine Bluff Arsenal, Arkansas
- Redstone Arsenal, Alabama

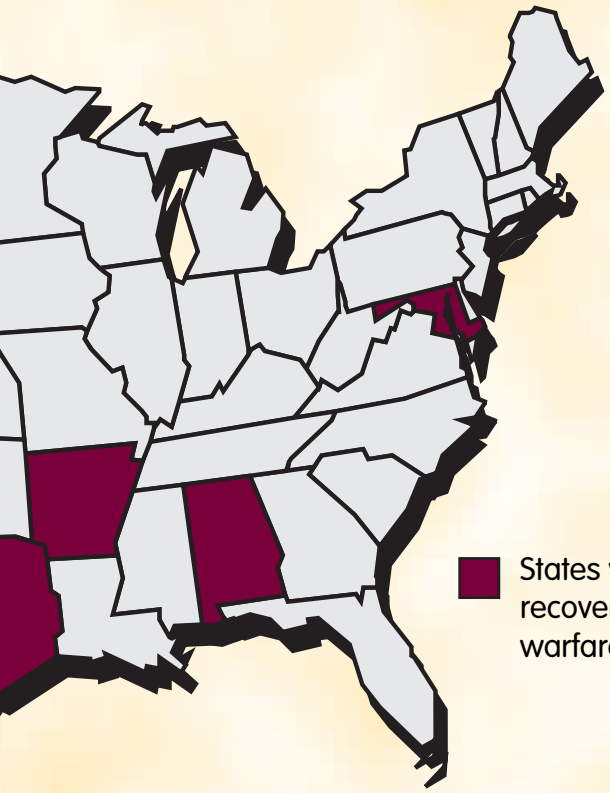


Recovered Chemical Warfare M

Recovered chemical warfare materiel (CWM) includes items recovered from range-clearing operations, chemical weapons burial sites, and other locations. When suspected recovered CWM is found, specially trained personnel are called to the site to assess the content and condition of the materiel and determine if it is safe for storage or transportation. Recovered CWM is currently stored at eight locations throughout the United States and on Johnston Island in the Pacific Ocean.

The Non-Stockpile Chemical Materiel Project is developing transportable treatment systems to destroy recovered CWM, since U.S. law prohibits the destruction of non-stockpile chemical materiel at stockpile destruction facilities in the continental United States. These provisions were set forth to assure citizens near stockpile sites that facilities would be dismantled once the local stockpile was destroyed. In some cases, state authorities will allow recovered CWM from other locations to be safely stored at stockpile sites until proper treatment and disposal plans are implemented.

When suspected chemical warfare materiel is recovered, the materiel must be characterized to determine if it contains chemical agent.



States with recovered chemical warfare materiel

Materiel

When suspected CWM is recovered, the materiel must be characterized to determine if it contains chemical agent. Instruments such as the Portable Isotopic Neutron Spectroscopy (PINS) system and the Raman Spectrophotometer help CWM specialists identify the contents of CWM without opening or destroying the materiel and possibly endangering the public, responder team personnel, and the environment. The Mobile Munitions Assessment System (MMAS) provides the Army with a quick-response and assessment capability when suspected CWM is found. It contains assessment equipment, such as the PINS and portable x-ray devices, as well as communications equipment, weather stations, a darkroom, and computer systems.

Once recovered CWM has been assessed, it is stored until treatment and disposal options are evaluated. CWM is declared under CWC after it has been characterized. Storage can be on site where the CWM is found, at another location in the same state or, with state and installation approval in each individual case, at appropriately permitted stockpile storage sites. Transportable treatment systems are being developed, such as the Rapid Response System (RRS), which is designed to treat recovered Chemical Agent Identification Sets (CAIS), and the family of Munitions Management Devices (MMDs), which are designed to treat recovered munitions and bulk containers of chemical agent.

Most recoveries involve very small quantities of CWM. The types of chemical containers usually recovered include CAIS, unidentified glass bottles, and metal containers. Recovered chemical munitions include artillery projectiles, mortar cartridges, and bombs.

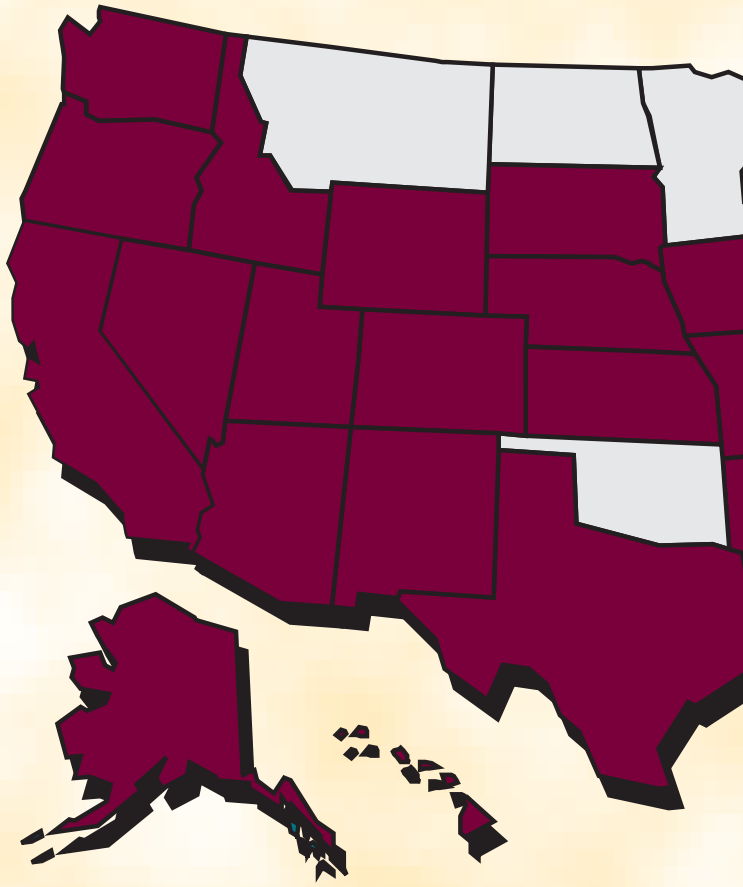
Recovered Chemical Warfare Materiel Storage Sites

Location	Amount and Type of Recovered CWM
Aberdeen Proving Ground	10 Munitions
Camp Bullis	25 CAIS* Bottles
Deseret Chemical Depot	64 CAIS Overpacks
Dugway Proving Ground	40 Munitions
Fort Richardson	7 CAIS Overpacks
Johnston Island	20 CAIS Overpacks 39 CAIS Sets 1 CAIS Bottle
Pine Bluff Arsenal	1,270 Munitions 5,299 CAIS & CAIS Components
Redstone Arsenal	1 CAIS Bottle 1 CAIS Set

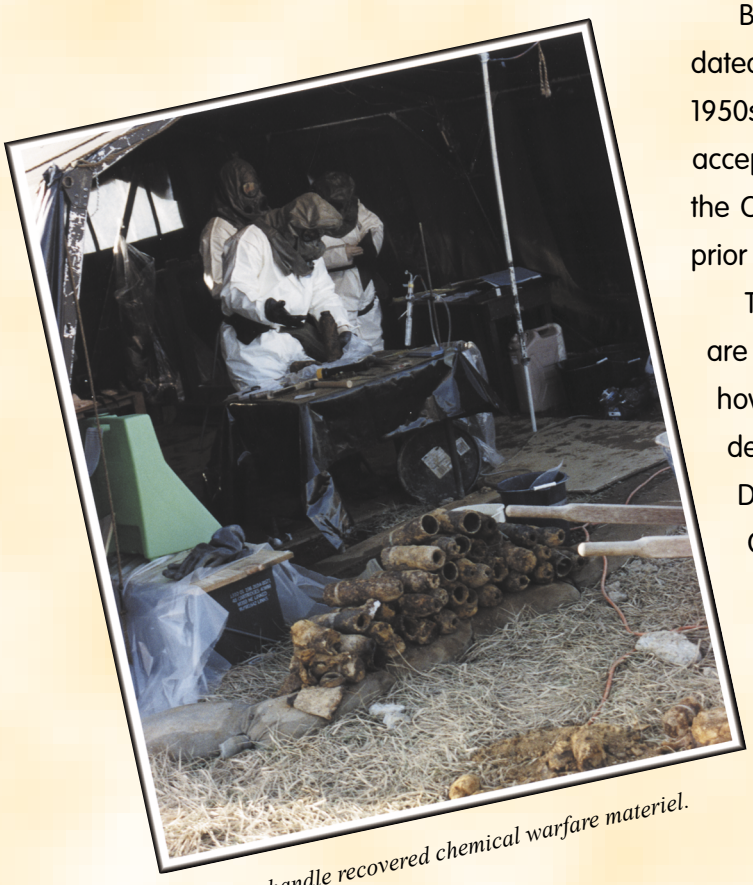
* Chemical Agent Identification Set (CAIS)

Suspected buried chemical warfare materiel locations:

- Alabama
- Alaska
- Arizona
- Arkansas
- California
- Colorado
- District of Columbia
- Florida
- Georgia
- Hawaii
- Idaho
- Illinois
- Indiana
- Iowa
- Kansas
- Kentucky
- Louisiana
- Maryland
- Massachusetts
- Michigan
- Mississippi
- Missouri
- Nebraska
- Nevada
- New Jersey
- New Mexico
- New York
- North Carolina
- Ohio
- Oregon
- Pennsylvania
- South Carolina
- South Dakota
- Tennessee
- Texas
- Utah
- Virginia
- Virgin Islands
- Washington
- Wyoming



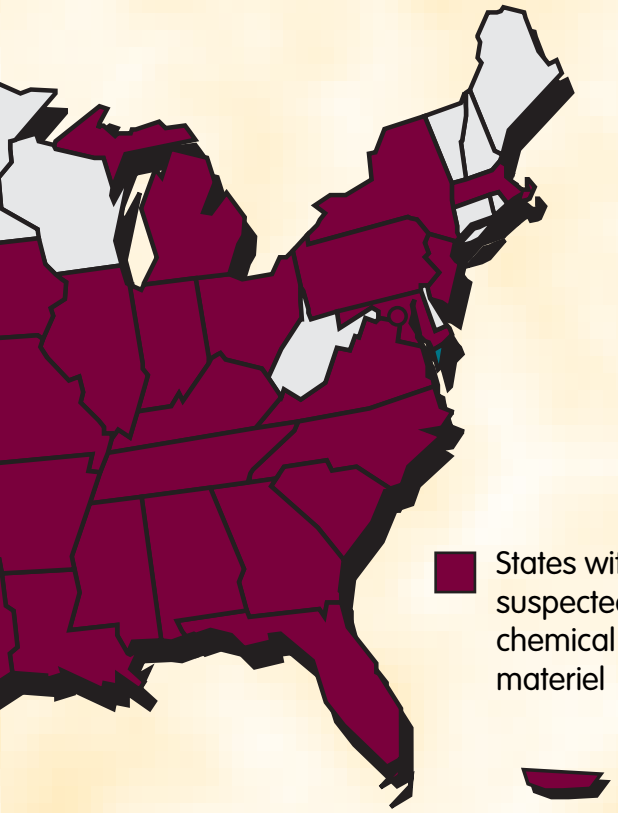
Buried Chemical Warfare Materie



Workers handle recovered chemical warfare materiel.

Buried chemical warfare materiel (CWM) can be dated back as far as World War I. Until the late 1950s, disposal of CWM by land burial was an accepted and approved practice. In most cases, the CWM was burned or chemically neutralized prior to its burial.

The majority of potential buried CWM locations are under military control. Some locations, however, may be found on formerly used defense sites (FUDS), which the Department of Defense no longer controls. The Non-Stockpile Chemical Materiel Project is responsible for buried CWM only after it is excavated. The overall tasks of locating buried CWM, deciding whether or not to excavate buried CWM, and how to remediate former burial locations rest with installation commanders, or with the U.S. Army Corps



of Engineers for FUDS. When CWM is found, organizations, stakeholders, and the public analyze each burial site to determine the best clean-up procedures in terms of health, safety, security, environmental protection, and cost.

The most significant challenge associated with buried CWM is the lack of available information concerning the condition, content, and exact location of the materiel. Even with the most sophisticated geophysical procedures, positive identification and assessment operations cannot be performed until the items are excavated from the site.

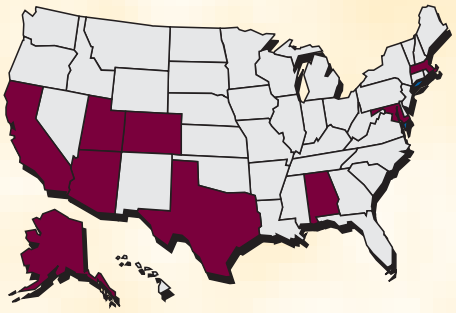
As of this writing, there are 229 suspected chemical warfare materiel burial sites at 99 locations spread across 38 states, the District of Columbia, and the U.S. Virgin Islands. The Department of Defense controls 53 of the locations, and the other 46 locations are FUDS.

The Non-Stockpile Chemical Materiel Project prepared a Survey and Analysis Report in 1993 that listed the suspected sites, quantities, types, and contents of munitions at each potential location. Each known site was assessed based on certain criteria including: current and previous usage, possible type of chemical warfare materiel, site population, and previous remediation efforts. After careful analysis of the available data, the sites were labeled as Known Burial, Likely Burial, Suspected Burial, Possible Burial, and No Further Action.

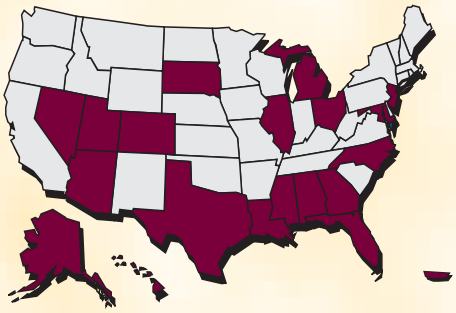
If a site has the potential of containing buried CWM, it is further divided into four categories: chemical agent identification set (CAIS) sites; small quantity, non-explosive sites; small quantity, explosive sites; and large quantity sites. CAIS items, training devices once used to help soldiers identify chemical warfare agents in combat, can be uncovered in metal or wooden containers. Small quantity, non-explosive sites have less than 1,000 CWM items and have no potential for explosives or propellants. Small quantity, explosive sites also have less than 1,000 CWM items, but items contain explosives or propellants. Large quantity sites have more than 1,000 CWM items.

There are 229 suspected chemical warfare materiel burial sites at 99 locations spread across 38 states, the District of Columbia, and the U.S. Virgin Islands.

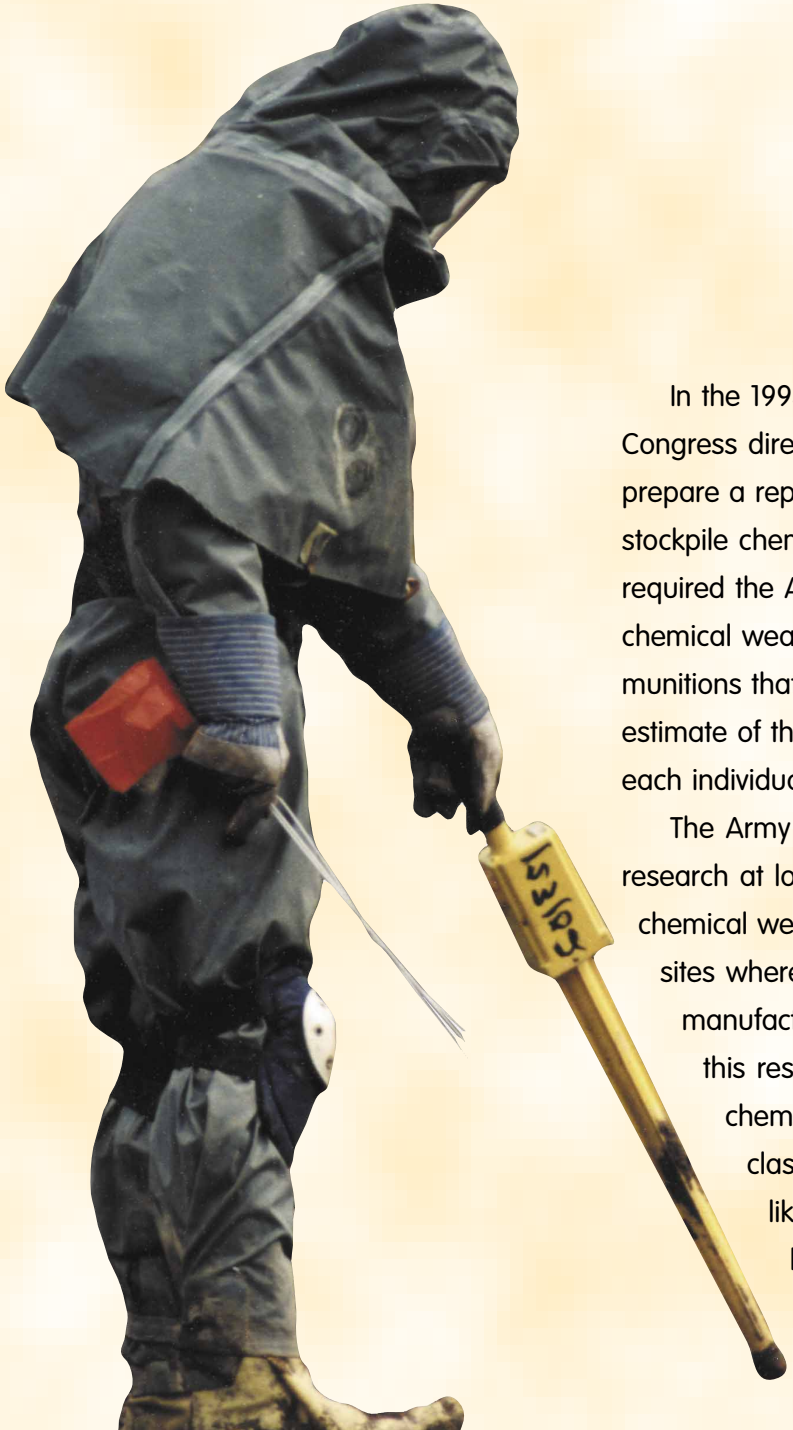
Five Classifications of Burial



Known Burial



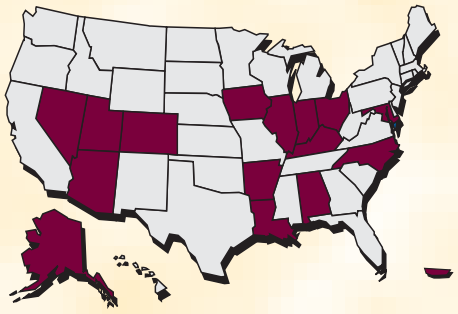
Likely Burial



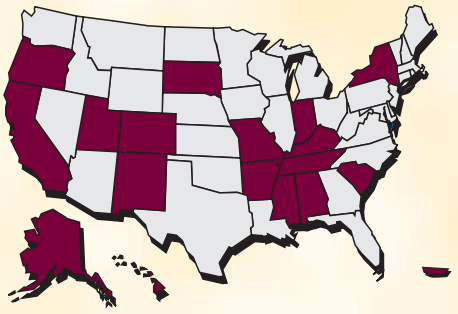
In the 1993 Defense Authorization Act, the U.S. Congress directed the Department of the Army to prepare a report detailing plans to destroy non-stockpile chemical warfare materiel. The law also required the Army to compile a list of suspected chemical weapons burial sites, the type of munitions that may be buried at each site, and an estimate of the numbers of weapons buried at each individual site.

The Army performed extensive site-specific research at locations where records indicated that chemical weapons may have been buried and at sites where chemical weapons were developed, manufactured, tested, or stored. As a result of this research, five classifications of buried chemical weapons were developed. These classifications are assigned based on the likelihood that chemical munitions may be buried at a specific site.

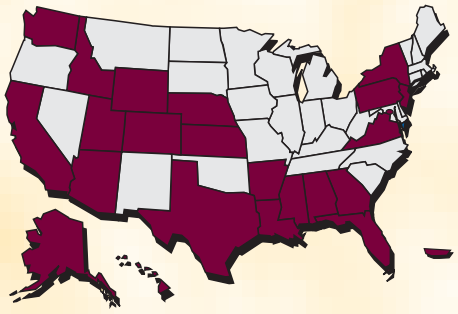
Sites



Suspected Burial



Possible Burial



No Further Action Burial

Classification 1 ~ Known Burial

Sites where the existence of chemical warfare materiel has been confirmed by site assessment or actual recovery.

Classification 2 ~ Likely Burial

Sites where one of the following conditions has been verified by historical records: burial of chemical weapons has been reported; the firing of chemical weapons under range conditions has been reported; and/or the disposal of chemical weapons by dumping in shallow water has been reported.

Classification 3 ~ Suspected Burial

Sites where it is strongly suspected that buried chemical weapons still exist even though records indicate that they have been destroyed. These sites are typically old disposal pits or firing ranges.

Classification 4 ~ Possible Burial

Sites where no documentation exists indicating burial, training, manufacturing, or storage of chemical agents, but activities performed on the site indicate that burial of chemical weapons is a possibility.

Classification 5 ~ No Further Action Burial

Sites where no further activity is warranted because site assessment has shown no buried chemical weapons, clean-up work has been completed, and/or the site is no longer accessible.

Industrial Chemicals and Ch

Properties and Effects on the Body

H, or mustard, is a chemical blister agent.

Agent/Toxicity	Color
VX High Toxicity (Chemical Agent)	Colorless to Amber Liquid
Sarin (GB) High Toxicity (Chemical Agent)	Colorless Liquid
Phosgene (CG) Medium Toxicity (Industrial Chemical)	Colorless Gas
Lewisite (L or M-1) Medium Toxicity (Chemical Agent)	Colorless to Amber Liquid
Mustard (H) Medium Toxicity (Chemical Agent)	Colorless to Pale Yellow Liquid
Adamsite (DM) Low Toxicity (Riot-Control Chemical/ Industrial Chemical)	Yellow to Green Solid
Chloroacetophenone (CN) (tear gas) Low Toxicity (Riot-Control Chemical/ Industrial Chemical)	Colorless to Gray Solid

During recovery of non-stockpile chemical materiel, different chemical agents and industrial chemicals may be found in various forms of munitions.

emical Agents

Odor	Rate of Action	Effect on Body
None	Very Rapid – Seconds to Minutes	Inhibits Nerve Conduction
None in Pure Form	Very Rapid – Seconds to Minutes	Inhibits Nerve Conduction
Mown Hay	Immediate to Delayed, Depending on Concentration	Impairs Breathing; Causes Fluid Buildup in Lungs
Geraniums	Rapid – Minutes	Blisters Eyes and Skin
Garlic or Horseradish	Delayed – Hours	Blisters Eyes, Skin, and Respiratory Tract
None in Pure Form	Very Rapid – Seconds to Minutes	Irritates Eyes and Skin; Causes Uncontrollable Involuntary Sneezing and Vomiting
Apple Blossoms	Very Rapid – Practically Instantaneous	Irritates Eyes and Upper Respiratory Tract; Causes Tearing

References:

Potential Military Chemical/ Biological Agents and Compounds, Army Field Manual No. 3-9, December 12, 1990

NIOSH Pocket Guide to Chemical Hazards, U.S. Department of Health and Human Services, June 1990

The Merck Index – 12th Edition, Merck Research Laboratories, 1996

Material Safety Data Sheets

Technologies and Transportable

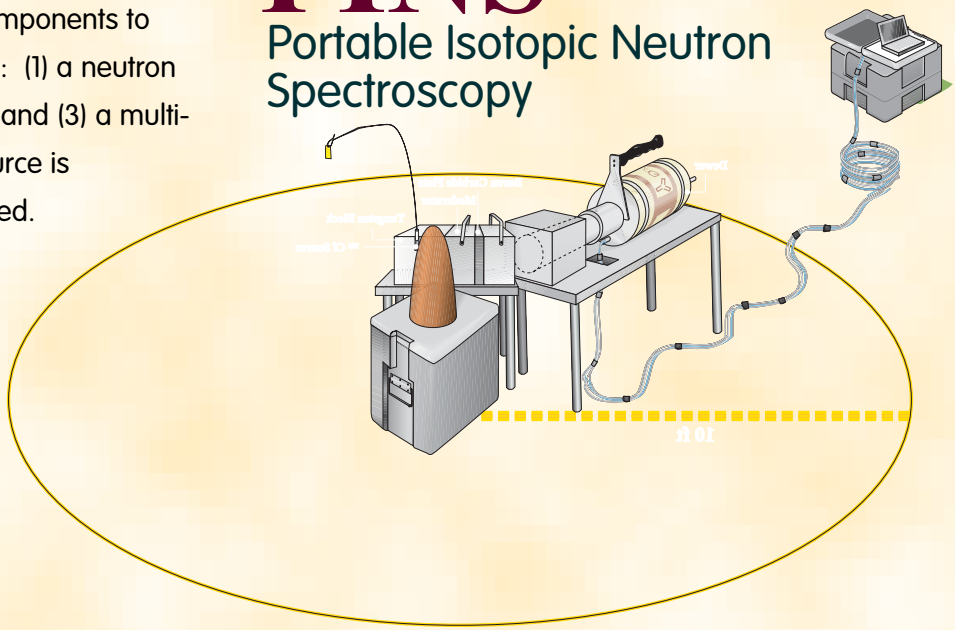
The Portable Isotopic Neutron Spectroscopy (PINS) system is a non-intrusive instrument that analyzes recovered munitions without opening or disturbing them. This portable identification technology allows for the safe handling and analysis of munitions with unknown contents.

The PINS system uses three components to identify elements inside a munition: (1) a neutron source; (2) a gamma ray detector; and (3) a multi-channel analyzer. The neutron source is placed near the item being analyzed. As the neutrons penetrate and interact with the munition, gamma rays, which are similar to x-rays, are produced. A gamma ray detector then monitors the energies and intensities of the gamma rays. A multi-channel analyzer powers the equipment and receives electrical impulses from the gamma ray detector.

Information received by the analyzer is sorted and converted into an energy spectrum that is analyzed. Since different elements produce characteristic energy spectra, the analysis can predict the presence and relative concentration of specific chemical elements with a high degree of precision.

PINS

Portable Isotopic Neutron Spectroscopy



This technology has been used for more than 40 years in geological studies, criminal investigations, analyses of food impurities, and detection of explosives at airports.

PINS Test Results (as of July 1998)

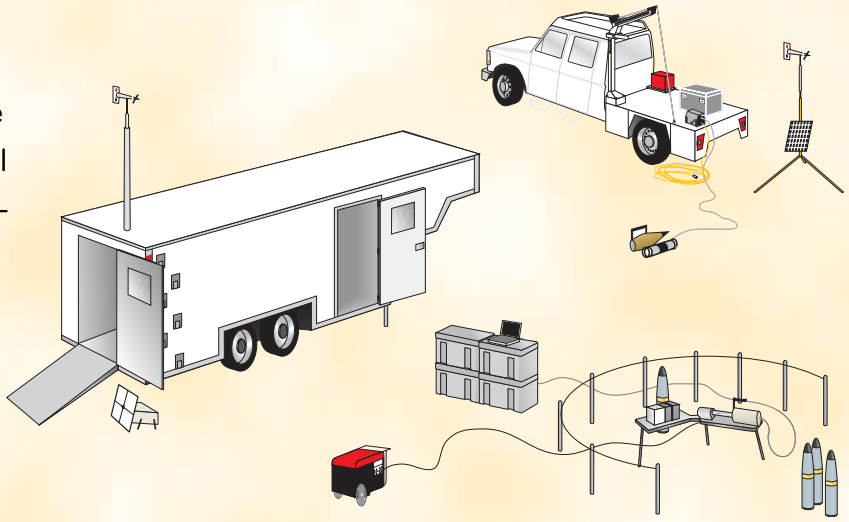
Munition Type	Number of Munitions Assessed	Number Containing CWM	Number Not Containing CWM	Number Correctly Classified by PINS (CWM/Non CMW)	Percent Correct
75mm Projectile	25	1	24	25	100%
105mm Projectile	9	7	2	9	100%
155mm Projectile	12	0	12	11	92%
175mm Projectile	17	17	0	17	100%
4.2-inch Mortar Projectile	22	0	22	21	95%
Livens Drum	6	3	3	6	100%
Miscellaneous	38	12	26	38	100%
Total	129	40	89	127	98%

Treatment Systems

The MMAS arrives at a site to begin assessment of recovered CWM.

The Mobile Munitions Assessment System (MMAS) is a transportable truck and trailer equipped to analyze and provide on-site information about the contents of unidentifiable munitions without opening them. It is designed to take equipment and instruments to the field, provide analyses, and communicate information to response personnel.

The MMAS uses the Portable Isotopic Neutron Spectroscopy system (PINS), as well as a portable x-ray device, to assess conventional or chemical-filled munitions. An on-board darkroom can rapidly process x-ray film. Two large masts equipped with meteorological sensors constantly monitor weather conditions, and cameras monitor all activity around the site. A portable electric generator allows the MMAS to remain at a site for months with a constant power supply.



MMAS
Mobile Munitions Assessment System

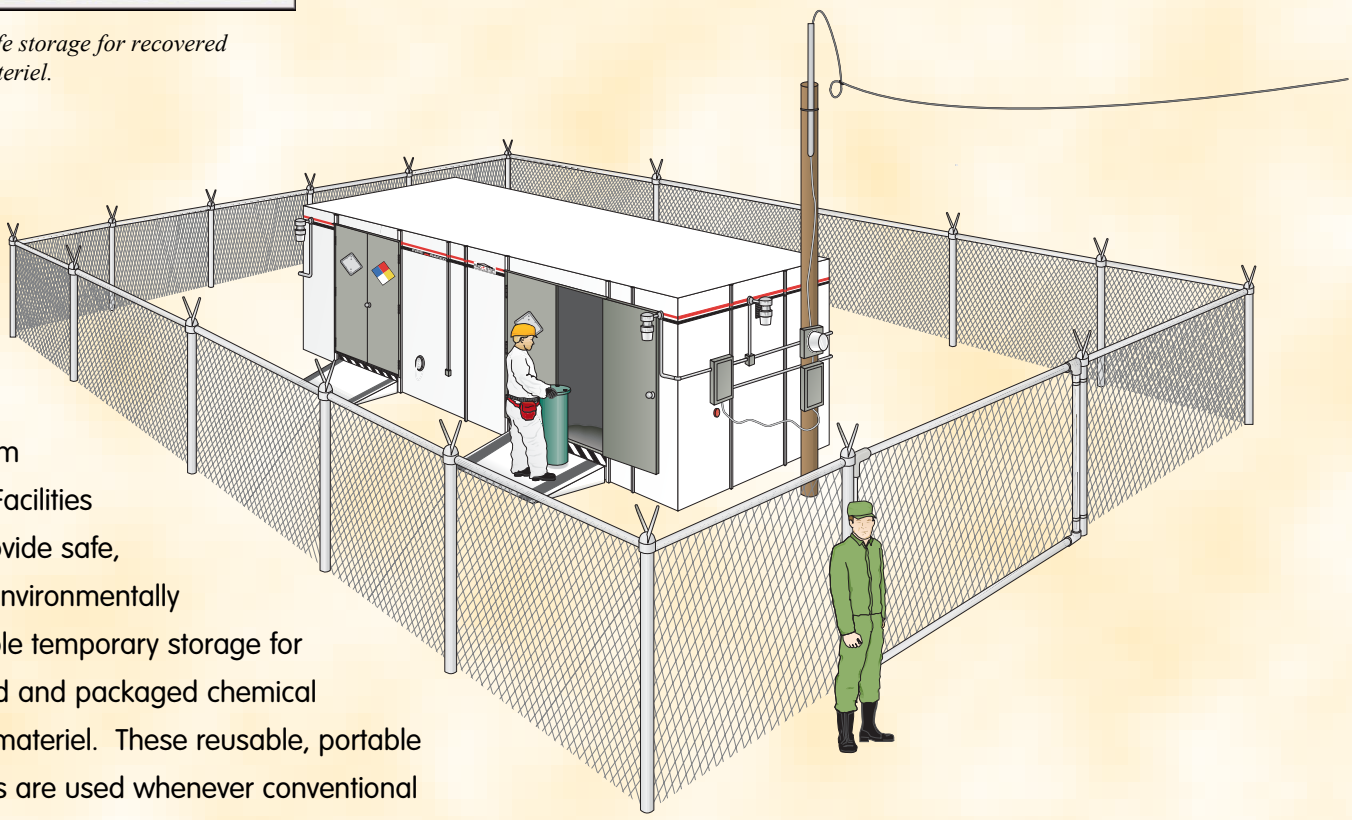
Data generated by the MMAS are stored in redundant computer systems, which have battery backup to ensure that no data are lost. A satellite link, cellular phone, and short-wave radio ensure that proper officials and local emergency responders have access to all information. The MMAS is also equipped to decontaminate personal protective gear and suits if necessary.

The MMAS can be transported by a C-141 cargo aircraft, if necessary, and then driven to a site. The system is equipped to provide access to sites with varying types of terrain. Once at a site, the MMAS can be set up in as little as 25 minutes.

The Non-Stockpile Chemical Materiel Project is currently developing and evaluating technologies and systems designed to identify, store, and treat the contents of recovered chemical warfare materiel.

Technologies and Tra

The IHF provides safe storage for recovered chemical warfare materiel.



Interim Holding Facilities (IHFs) provide safe, secure, environmentally acceptable temporary storage for recovered and packaged chemical warfare materiel. These reusable, portable structures are used whenever conventional munitions storage facilities, such as ammunition bunkers or magazines, are not available.

IHF
Interim Holding Facility

Each IHF is constructed of corrosion-resistant, fireproof material and has a secondary containment area below the floor to safely hold leakage should it occur. An air conditioning system maintains internal temperatures to reduce vapor hazards of stored materials. Light switches and fixtures, outlets, and air conditioners meet strict, non-explosive design requirements to reduce the risk of fire inside the IHF.

The IHF has double-locked security that includes a fenced area. Security and agent monitoring are maintained until the recovered materiel is relocated for treatment or disposal.

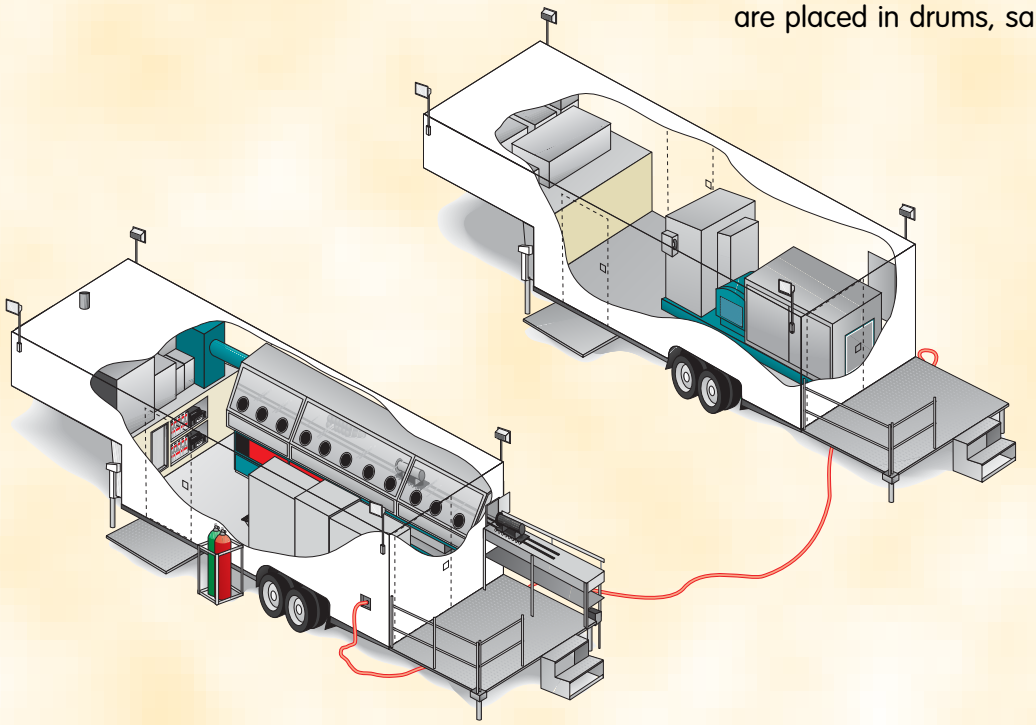
Each Interim Holding Facility is constructed of corrosion-resistant, fireproof material and has a secondary containment area below the floor to safely hold leakage should it occur.

nsportable Treatment Systems

RRS
Rapid Response System

The Rapid Response System (RRS) is a transportable treatment system that provides the capability to receive, contain, characterize, monitor, repackage, and treat Chemical Agent Identification Sets (CAIS) recovered at burial or storage sites. CAIS were once used to train soldiers in the safe handling, identification, and decontamination of chemical warfare agents. The sets consist of small quantities of chemical agents or industrial chemicals in glass ampules, vials, or bottles.

The glovebox apparatus of the RRS.



The RRS uses two trailers: an Operations Trailer, where the glass containers are processed using a glovebox apparatus; and a Utility Trailer, which provides electrical power for the equipment. CAIS enclosed in steel overpack containers are first moved to the airlock station, where a sealed environment is created. The overpack containers are cut open at the unpack station and the bottles and vials are removed and identified. At the neutralization station, chemical agent from the bottles and vials is mixed with a decontamination solution. Wastes are placed in drums, sampled, and analyzed before they are transported to a permitted waste treatment and disposal facility.

Air inside the glovebox passes through a dual redundant carbon filtration system to capture any contaminants before it is discharged. Air inside the Operations Trailer is continuously monitored for the presence of chemical agents and industrial chemicals to ensure worker and public safety. Whenever possible, the Operations Trailer is enclosed in a tent-like environmental closure as an added measure of protection.

Technologies and Transportable

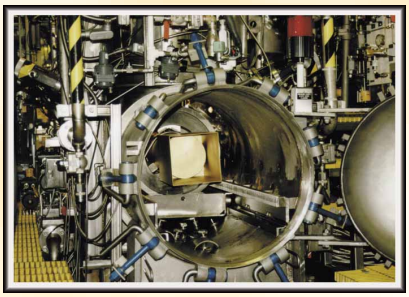
Munitions Management Device (MMD) systems are state-of-the-art transportable treatment systems designed to receive, contain, access, monitor, and treat explosive and non-explosive chemical warfare munitions and bulk agent containers. A variety of recovered chemical warfare materiel (CWM) may be treated using MMDs, including bombs, artillery projectiles, or ton containers that contain chemical agent.

MMD
Munitions Management Device

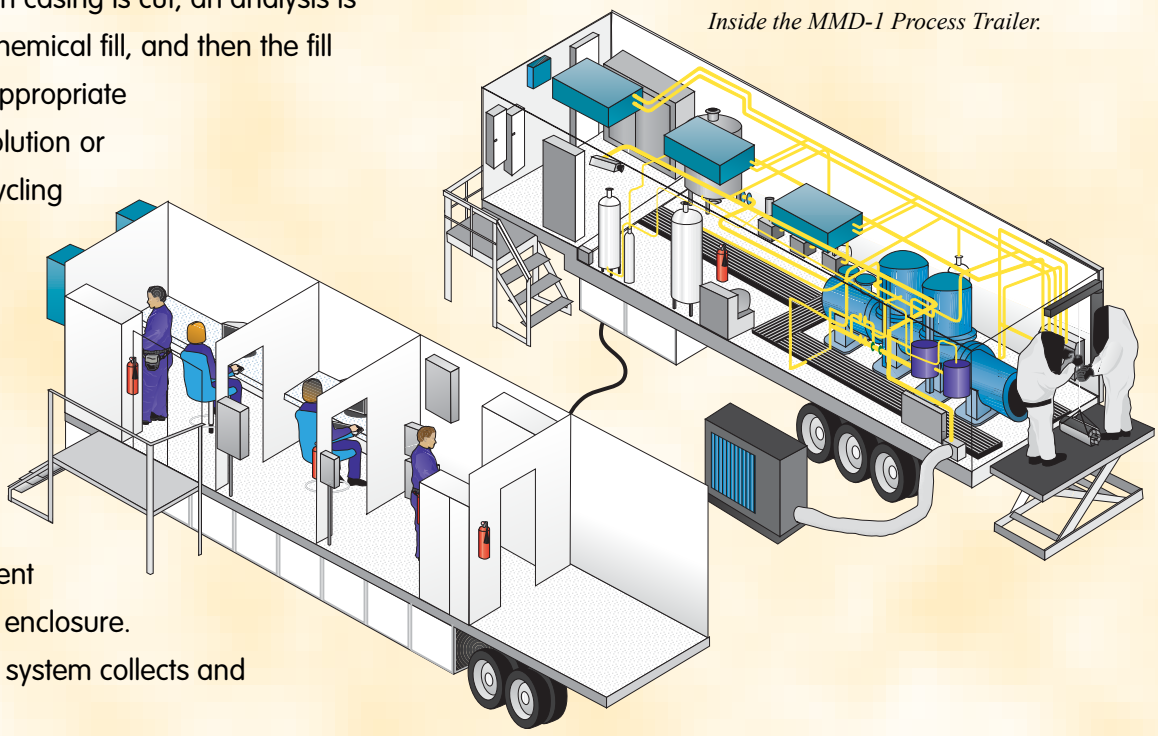
The MMD-1 will treat non-explosively configured CWM weighing up to 500 pounds through the use of a Control Trailer and a Process Trailer. Operations are remotely directed and monitored from the Control Trailer, while a three-step treatment process is conducted in the Process Trailer. During this process the munition casing is cut, an analysis is conducted on the chemical fill, and then the fill is treated with an appropriate decontamination solution or repackaged for recycling or disposal.

The Process Trailer is built with reinforced stainless steel sheeting that isolates the chemical agent processing equipment inside a vapor-tight enclosure. The gas processing system collects and decontaminates all vapors from the liquid processing system. The decontaminated vapors are then processed through several carbon filtration units. Air inside the sealed Process Trailer is continuously monitored for the presence of chemical agent or industrial chemicals to ensure worker and public safety. Whenever possible, the Process Trailer is enclosed in a tent-like environmental closure as an added measure of protection.

Other MMD systems are planned that will treat non-explosively configured CWM weighing more than 500 pounds, explosively configured CWM, and large bulk containers of chemical agent.



Inside the MMD-1 Process Trailer.



Treatment Systems

EDS

Explosive Destruction System

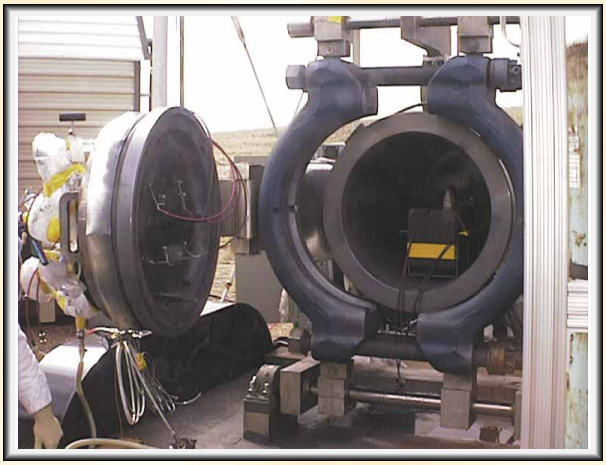
The Explosive Destruction System (EDS) is a transportable system designed to safely detonate munitions inside a sealed pressure vessel and neutralize their chemical agents while maintaining worker and public safety. The EDS is specifically designed to handle World War I and World War II era munitions that are explosively configured and unsafe for transport or storage. Its versatility provides promise that it will be useful for treatment of other types of CWM.

The EDS pressure vessel contains all agent and waste from the munition. A cylinder-shaped fragment suppression system allows the EDS to withstand repeated explosions without damage to the pressure vessel, while totally containing old agent and waste from munitions. The steel fragment suppression system is divided horizontally into two sections. The lower half of the cylinder connects to a steel cradle and rings that provide shock absorption. A munition is placed inside the fragment suppression system and sealed inside the EDS pressure vessel.

Explosive charges placed on the munition break it open and detonate the burster. After the munition is opened, a sample is taken to verify the type of chemical fill. If agent is present, neutralization chemicals are added to the vessel, and it is heated and rocked to mix the contents.

After the neutralization process is complete, the vessel is emptied. Only small pieces of the munition, the fragment suppression system, and the cradle remain after detonation. All waste from the vessel is disposed of according to applicable federal, state, and local laws.

The EDS Phase I, the first version of the Explosive Destruction System, was fabricated and accepted for systems testing in 1999. This system has the capacity to handle all mortar shells and small artillery projectiles. Fabrication of the EDS Phase II, for larger artillery shells, began in 1999.



The EDS Phase I during testing operations.

The EDS has a cylinder-shaped fragment suppression system that allows it to withstand repeated explosions without damage to the pressure vessel.

PMCD

Program Manager for
Chemical Demilitarization

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